are cool and wet. Bronchitis, pneumonia, and asthma increase as the temperature falls, and diminish as it rises. The damp, cold days of November, and the dry, cold days of the early months of the year, have been most prolific in cases of diphtheria. As to hydrophobia, the hot 'dog-days' of summer are generally considered to be those during which this disease is most prevalent; and this ancient belief is justified to some extent by facts, although we must remember that it shows itself to be independent, in its spread, of a high temperature, as the mortality in London during thirty years proves. The number of cases is as numerous in December as in August. More persons, doubtless, are bitten by dogs in hot weather, because dogs are more irritable during this season. We want an answer to the query as to the percentage of cases of hydrophobia in those who are bitten in each month of the year, before we can determine with certainty the influence of meteorological conditions on the disease. In this section are also given directions for observing the meteorological states and variations in the conditions of the air, as to its pressure, temperature, and moisture, the direction and strength of the wind, and its electrical state.

The last section of the book is taken up with a consideration of the food, its impurities, and methods of inspection and examination, including the inspection of meat, poultry, game, fish, fruit, and vegetables. Separate chapters are devoted to tinned provisions, corn, flour, bread, and milk. On the subject of tinned provisions, or 'canned goods,' as we should call them, Dr. Fox says that preserved Australian meats, and American tinned fish, fruit, etc., are apt to become impregnated with small quantities of lead from the solder and tin, which frequently contain, as impurities, arsenic and antimony. The vegetable and other acids associated with these provisions have a corrosive effect, which is increased by the galvanic action set up between the metals. In the chapters on milk and its examination the author gives numerous instances of disease caused by impure milk or by that from sick cows. The evidence that tuberculosis may be thus communicated is very striking and very convincing, if, indeed, there be any at the present day who, having given the subject any consideration, doubt it. Taken as a whole, this work of Dr. Fox is an excellent one, and should be in the library of every sanitarian and physician.

A PHYSICIAN of Caracas reports, that, during an epidemic of yellow-fever which occurred in that place, one of the victims was a monkey. After an illness of four days, the fever proved fatal.

SCIENTIFIC WRITINGS OF JOSEPH HENRY.

AT last, although somewhat tardily, as it has seemed to many, the regents of the Smithsonian institution, by the publication of these volumes, have enabled the general public to form a correct estimate of the great services of its first secretary, and have justified the opinion, long held by many of his countrymen, that Joseph Henry was unquestionably the first American physicist of his time. The Smithsonian institution, with the national museum, has been generally recognized as a monument to his wisdom, foresight, and patriotic self-sacrifice. How great this sacrifice was, demanding, as it did, almost total neglect of original research, — which he so loved, and for which he was so well fitted, — will be clearly understood on a perusal of these volumes.

The published papers of Henry, especially the earlier, and in many respects the most valuable, have long been well-nigh inaccessible. In later years he was too busy to follow the example of other eminent philosophers in collecting, editing, and republishing the work of his early years. Although an avenue for such reproduction of his numerous contributions to science was always open to him in the publication department of the Smithsonian institution, he never consented to utilize the facilities which he had so thoughtfully perfected for his fellow-workers, and which have proved such a boon to science and to scientific men.

The two handsome volumes now issued, naturally include a wide variety of subjects. The collection of papers is divided into two parts: a chronological arrangement is, in general, followed. But in order to equalize the size of the two volumes, the elaborate studies of and reports upon various phenomena connected with the transmission of sound, made between 1873 and 1877, while Henry was a member of the lighthouse board, are inserted out of their regular order, in the first volume.

Part i. includes papers published while a professor at Albany and afterwards at Princeton. This record covers a period of twenty-three years, from 1824 to 1846. It is contained in the first 260 pages of the first volume. Part ii. contains his scientific work during the remaining thirty-two years of his life, while director of the Smithsonian institution, from 1847 to 1878. Physicists will generally be most interested in part i., which contains nearly all of his original researches in electricity.

Born only five years later than Faraday, much

Scientific writings of Joseph Henry. 2 vols. Washington, Smithsonian institution. 8°.

of Henry's work ran parallel with that of the most distinguished experimental physicist of this or, indeed, any age. In several instances they attacked the same problem almost simultaneously, and often independently of each other. The great discovery by Faraday, on Sept. 24, 1831, of electromagnetic induction, inaugurated an era of greatly increased activity in electrical research. Henry had thought much concerning the relation of magnetism to electricity, and had devoted the early part of the same year to his very important research looking to the improvement of the electro-magnet, with the intention of making use of it in an attack upon the then unsolved problem. The pressure of other duties prevented him from taking up the work until after the commencement of Faraday's success, but his improvement of the magnet was of sufficient importance to stand alone as a most valuable contribution, since through it Morse's system of telegraphy was made possible.

He at once repeated Faraday's experiments, and extended them, with interesting results. The difficulties under which he labored, arising out of his occupation, and also from the difference, far greater then than now, between London and Albany or Princeton as centres of intellectual activity, were more considerable than those which his distinguished contemporary was obliged to overcome. Those were the days in which quantitative measurements in electricity were made by comparison of sparks produced on file and rasp, by observing rapidity of decomposition, by the magnetization of sewing-needles, or in which men *felt* their way to results through shocks in the arms, fingers, or tongue. In those days batteries were inconstant and short-lived, connections were made with mercury cups, conductors were carefully insulated by a silk covering put on by the experimenter himself, and 'bell-wire' was almost the only available material for circuits. Henry independently produced the spark from the magnet, but afterwards learned that he had been anticipated in the observation in England. In 1832 he discovered self-induction in a long wire, and correctly, though somewhat hesitatingly, interpreted the phenomenon. This was not observed by Faraday until 1834, and at first he did not comprehend the true nature of the operation. He corrected his error in 1835, and the credit of the discovery has been generally accorded to him. At an early date, Henry produced current-induction by means of 'common' electricity, which Faraday had not at first been able to accomplish.

In one of his numerous variations of Faraday's experiment, in which he used flat coils or spirals, he tried the effect of interposing a conducting-plate between the primary and secondary coils. He found that the shock from the secondary coil was almost totally destroyed by the introduction of a plate of copper or other conducting-material between it and the primary.

This was an important conclusion, and led to important results. Shortly after its publication, he received from Faraday a copy of his fourteenth series of experimental researches, in which he makes a statement diametrically opposed to that of Henry in reference to this effect, being, in substance, that the interposition of a conducting-plate made not the slightest difference in the result. This naturally excited in Henry a lively interest in the question, and he made an extensive investigation in order to determine which view was erroneous.

Curiously enough, both were correct. Faraday used a galvanometer in his experiments: Henry observed the strength of shocks, or the physiological effect. There are undoubtedly induced currents in the interposed conductors; but they will be transient, and their integral effect on the number of lines of force passing through the secondary will be zero. The effect, then, will be that the time of the rise and fall of the induced current will be altered. The variation taking place within a small fraction of the period of the galvanometer needle, the throw of the needle will not be changed; but the effect of the shock will be greatly modified, and may become insensible. Henry did not leave this question until he thoroughly understood the cause of the discrepancy.

The most important result of his original experiment, however, was that it led him to the discovery of induced currents of the second, third, and fourth orders.

It is not possible to refer, in this place, to many other investigations of great interest which are to be found recorded in part i. A few of them relate to other departments of physical science, and some of them are not well known, even to his own countrymen. On the very first page will be found an account of a most admirable lecture experiment, which might well find a place in our modern courses, but which is probably not generally known to professors of physics.

Many lovers of pure science will find it hard, after a perusal of part i., to avoid a feeling of regret that Henry was not allowed to continue his researches, instead of being called to the directorship of the Smithsonian institution. That he was exceptionally well qualified for this important post, no one will deny, although it must have been accepted at a sacrifice which no one understood better than Henry himself. Throughout his long connection with the institution, and during a career which needs no praise and requires no comment, he con-

tinued his scientific work whenever opportunity was offered. But this work was largely of a character different from that of his earlier years. Many of his papers in the first part show that his nature was too large to permit of his assuming, as some men of science have assumed, and even boastfully, an absolute indifference as to the so-called practical applications of his investigations, and their worth as a means of bettering the condition of mankind. His work while director of the Smithsonian was very closely related to applied science. He was now called upon to consider and decide questions of great practical importance. Much of his time, which he would doubtless have gladly given to researches of a higher order, was occupied in devising methods of testing materials for public buildings, in considering the acoustics of public halls, in investigating the relative value of illuminants for the light-house board ; and in the capacity of chairman of this board he planned and executed the extensive and important series of experiments and investigations on the use of fog-horns, steam-whistles, etc., and on the transmission of sound, which are printed at length in the latter part of the first volume. A large part of the second volume is devoted to an extended series of essays on meteorology. This was a subject in which Henry had always been interested. On the organization of the Smithsonian institute, he had named meteorology as one of the subjects the investigation of which could properly be assumed by the new establishment. As early as 1848 he suggested the use of the telegraph in the study of American storms, and explained the benefit which would accrue to commerce and agriculture from its use in the dissemination of weather-warnings. He organized a gigantic system of voluntary meteorological observers, by the aid of which much light was thrown upon the climatic conditions of the country. All of the meteorological work of the institute was finally turned over to the U. S. signal service upon its organization, and the success of this service was and is largely due to Henry's labors as a pioneer.

His essays on meteorology were in plain and unpretentious language ; the medium of their publication was such as to secure their wide distribution and diffusion among the masses of the people; and the general interest in the subject to-day, as well as the general intelligence of the public in regard to it, must be largely attributed to their influence. These essays constituted the first easily accessible scientific treatment of the physics of atmospheric phenomena which appeared in this country, and they contain much matter of great value to the meteorologist of the present time.

The reader will thank the editors for including in this collection several essays and addresses to scientific societies concerning their organization and working-plans, which, although not strictly scientific, have had, and will continue to have, an important bearing upon the progress of science. In every respect the work of compilation seems to have been done with exactness and care ; most readers, however, would have welcomed the addition of a good portrait and a brief biography.

The publication and circulation of these volumes will enable scientific men, both at home and abroad, to make a juster estimate of Henry's great services to science, and the study of his earlier researches must convince competent judges that he was one of the really strong physicists of the first half of the present century.

STORER'S AGRICULTURE.

UNDER the modest title of 'Agriculture in some of its relations with chemistry,' Professor Storer has given us what, in our judgment, is the most noteworthy contribution to agricultural literature of recent years, either in this or any other country. We say this advisedly, and after a careful examination of the book.

It may be said to treat broadly of manures and fertilizers, or better, perhaps, of 'plant-feeding,' since it includes, along with the main topic of manures and manurial substances and their application, much with regard to the plant itself ; the soil and atmosphere, which are the media of its growth, and from which its food is derived ; the culture and handling of different crops ; and the adaptation of crops and systems of farming to local conditions.

The subject is a difficult one to treat satisfactorily, on account of its complexity and also because of the very imperfect state of our knowledge upon it in many directions, and accordingly there has been a dearth of good books upon it. As regards the English language, the dearth may be said to have been absolute. There has been hitherto no book treating of these matters which could be recommended to a student who desired any thing remotely approaching a thorough and systematic acquaintance with the present state of our knowledge on this subject.

The students of other countries have been somewhat better off ; but even there, so far as the writer's acquaintance with the literature of agriculture extends, there has been no one work which adequately covered the whole field of plant-feeding in its scientific and practical aspects. This

Agriculture in some of its relations with chemistry. By F. H. STORER. New York, Scribner. 8°.